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ABSTRACT

The objectives of this study were to develop comparative research data on two library instruction methods in order to improve student skills in collecting information, evaluating material critically, and communicating effectively through writing, as well as to evaluate a methodology for the assessment of library instruction. The traditional orientation lecture was provided near the beginning of the semester to two sections of a technical writing class for undergraduate engineering students. In two other sections, instruction in CD-ROM databases, end-user online searching, and traditional sources was integrated into the curriculum. A total of 56 technical writing students completed the requirements of the study and provided research papers for data analysis. The Kohl/Wilson scoring method was used to check each bibliography to determine: (1) if the source use was appropriate for the topic; (2) if the source selected represented the need for current versus retrospective materials; and (3) the quality of the source for the topic. Results indicated that the addition of automated bibliographic sources had not made a difference in the bibliographies. The project will be continued for four more semesters. (22 references) (MES)

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for

College Library Technology and Cooperation Grants Program
Higher Education Act, Title II-D
(CFDA NO. 84.197)

UNITED STATES DEPARTMENT OF EDUCATION

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Part I -- General

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2. Frances Benham, Project Director
   Associate Dean of Libraries for Collections and Information Services
   205-348-5569

3. Grant Number R 197A80299
   January 1, 1989 - December 31, 1989

4. Grant amount awarded -- $84,545
   Actual amount expended - $127,598.26

Part II — Narrative Account

1. Goals established for the first round of the study were met. A comparison was made of the output in the form of bibliographies attached to term papers prepared by technical writing students in experimental and control groups. The comparison is detailed in the attached narrative.

2. Changes, approved by telephone contract with Linda Loeb, were made in the budget. Equipment changes were necessitated by changes in IBM's product line. Personnel changes were necessitated by schedules, workloads, and job changes of those involved. A revised budget was sent to Linda Loeb. Changes needed after that submission were approved by telephone and are indicated by the figures included on the Financial Status Report.

3. There is no immediate effect of this Federal project on the population served. Rather the first round ha produced information of use to the researchers which will be utilized in the second round, now in progress. A total of five rounds are included in the project.

4. This Federal project was not designed to increase resource sharing activity, but rather to develop data about two modes of library instruction, one of them including the use of automated bibliographic information resources.

5. The assessment of the project is attached.

6. The project was approved for three years. The second year budget has been approved and is being implemented. Application for the third year budget is in preparation and will be submitted by April 20, 1990. The project, currently housed in a temporary laboratory, will be moved to the new Science and Engineering Library in the summer of 1990 in time for round three of the project in the fall of 1990.

Approved as a Research and Demonstration project, the following narrative includes:

1. A description of dissemination activities and the results of the project's evaluation plan, including data on the impact on technical writing students involved.

2. The innovation use of end types of technology employed in the project.

3. Plans to continue and to build upon this three year project.

NARRATIVE

The project evaluated two methods of instruction provided undergraduate engineering students in a technical writing course -- the traditional orientation lecture and the traditional lecture supplemented with intensive course-integrated training in the use of automated information sources including CD-ROM and, to a lesser extent, end-user online searching. Evaluation focused on bibliographies produced as part of the requirement of a term paper for the course.

Background

In its report Reform on Campus (in 1972), the Carnegie Commission on Higher Education cited as a factor in the necessity for change in higher education a vast increase in human knowledge. It noted that as the rate of new knowledge is added to the tremendous existing body, it becomes imperative that students learn how to keep abreast of changes both as students and throughout life.[1]

Managing the flow and use of literature has been a source of concern to the scientific community since the eighteenth century development of the specialized journal.[2] The application of automation to publishing with its resulting datafiles suggested to Eugene Garfield in the 1960's that the fulfillment of Vannevar Bush's dream of a scholar's workstation to provide such control (universal bibliographic control), might become possible.[3] By 1982 electronic publishing had, in fact, made possible over 1,000 publicly available databases; by mid-1984 that number had more than doubled.[4] Today data are increasingly generated in machine-readable form only.[5] Indeed, the scientific journal itself has been questioned as an economical and effective

means of communication when compared with the speed, cost, and more flexible distribution of text and data made possible by electronic publishing.[6,7] Numeric databases, available first on magnetic tape and now on optical disk, are beginning to be found in libraries beside bibliographic datafiles and traditional print materials.[8]

The Carnegie Commission, noting not only the increase in knowledge, but also its rapid evolution, indicated that the teaching of existing knowledge had become comparatively less important than imparting skills needed for continuing self-education through independent study.[9] Among its basic recommendations for change in higher education, the commission included the need for increased emphasis on the library as an active participant in the instructional process.[10]

Academic libraries have long supported user instruction programs. The works of Harvie Branscomb,[11] Billy Wilkinson,[12] Patricia Knapp,[13] and Evan Farber[14] provide models for the profession. In the years since the commission report, substantial attention has been directed to various methods deemed appropriate for user education. The orientation tour, the introductory lecture on basic reference works, and the separate library use course have all been touted in the literature. Several notable programs, such as that at Earlham College, have integrated library instruction into the curriculum. Though this method appears to be the most respected by librarians, there is no research data to support claims made for its effectiveness.[15]

Kohl and Wilson reviewed the literature of bibliographic instruction evaluation and observed it to have focused on the following four areas:

1. student perceptions of the value of such instruction,

2. changes in student attitudes resulting from such instruction about the library and its staff,
3. student preference for or the effectiveness of one type of instructional presentation over another, and
4. student ability to answer questions about possible uses of specific library resource tools in a test situation.[16]

Indeed, the literature on library instruction is striking in its consensus among students, faculty, and librarians of its efficacy in the improvement of perceptions about the library and/or librarians, in the growth in knowledge of basic information sources, and in the motivation of students when instruction is related to a specific objective. The consensus holds despite the lack of comparative data relating library instruction to the improvement of works of scholarship. Such research efforts, admittedly plagued with methodological problems arising from the complexity of human interaction, nonetheless, might provide useful insight, if not a one-to-one cause and effect relationship, among instruction and outcome variables.

Kohl and Wilson reported findings on the relationship between a method of library instruction and the quality of bibliographies of student term papers as judged in blind evaluations by a librarian and the course instructor. Papers to be compared were randomly selected from a number of class sections that had received one type of instruction and from an equal number of other sections that had received another type. Each bibliography was scored on the basis of:

1. Appropriate type of source for the topic (books, encyclopedias, etc.)
2. appropriate use of current vs. retrospective sources

3. quality of sources for the topic (popular vs. scholarly sources)[17]

Ratings of the two evaluators were subjected to statistical analysis and found to be significantly correlated. The second, and most pertinent, issue was whether library instruction content made a difference in the bibliographies produced. T-tests were utilized to determine whether there were statistically significant differences between the ratings assigned the bibliographies of those students who received one type of instruction and those who received another. Data derived indicated that there was a statistically significant difference in favor of one type of instruction.[18]

Kohl and Wilson developed an innovative and methodologically sound approach to the assessment of library use instruction. Although samples studied were small, results suggested that data could be gathered which might reliably guide judgments in the difficult area of evaluating library instruction.

Project Objectives

The objectives of the project were to develop comparative research data on two library instruction methods (the traditional lecture and course-integrated instruction emphasizing the use of CD-ROM and end-user online searching) in order to:

a. improve student skills in collecting information efficiently and effectively

b. improve student skills in evaluating material critically

c. improve student skills in communicating effectively through writing

d. evaluate a methodology for the assessment of library instruction

The University Library system has provided a formal program of library instruction for students enrolled in freshman English for the past fourteen years. That program, expanded over the past four years through the involvement of graduate student interns from the School of Library and Information Studies, provides basic library use training for over 3,000 students per year. As well, the Library Instruction Department provides additional discipline related programs per year. These range in instructional requirements, depending upon the requesting faculty member, from tours to intensive instruction in the literature of a given discipline.

Until recently the College of Engineering did not place much stress on the use of scientific literature or writing skills at the undergraduate level. In response to the rapidity of technical development and resulting technical obsolescence within the profession at large,[19] the engineering curriculum has become more theory based with concomitant emphases on use of the literature and on communication skills. The engineering faculty, eager to encourage such improvements, has embraced the library's objectives for this project with their students.

Together the University Library and the engineering and science faculties planned for the new Science and Engineering Library to encourage to the fullest student development of information gathering and utilization skills. To this end an electronic laboratory was planned for the new library in cooperation with the School of Library and Information Studies, representatives from IBM, and the University Computing Center.

The electronic laboratory was designed not only to provide education in the use of current technologies, but also to examine state-of-the-art developments in information retrieval and dissemination. Research in the electronic laboratory was projected to be the joint responsibility of the University Library system and the School of Library and Information Studies (SLIS). SLIS' first doctoral class was enrolled in the fall of 1988, and it was expected that the electronic laboratory would provide substantial opportunity for doctoral research. As well, the University Library system and SLIS have long shared a master's degree internship program for library service students. The electronic laboratory could provide this program new internship opportunities. Finally, it was hoped that the information industry might view the electronic laboratory as a test site for new products.

The instructional project utilized the test and evaluation methods described by Kohl and Wilson with modifications, in a series of studies to be conducted over five semesters. This report analyses round one of that series. Because of the difficulties inherent in research efforts to draw conclusions concerning human behavior, it was believed that the research results would be strengthened considerably by consistent replication. Moreover, it was believed that if an instructional method, such as course-integrated library instruction utilizing automated information technologies, makes a difference in scholarly output of engineering students, such results should be observed consistently in varying circumstances over time. The evaluation of bibliographies of student papers from various course sections was intended to minimize the influence of instructor idiosyncracies.

For each of five semesters two instruction methods will be utilized with students enrolled in technical writing course sections. Technical writing is

required for some undergraduate engineering majors. Other engineering majors strongly recommend it as an elective. As well, students enrolled in other disciplines may take the course as an elective. Typically students enrolled in the course are engineering majors with several students in each section from other disciplines. In round one, fall semester, 1989, the traditional orientation lecture was provided by librarians to two sections near the beginning of the semester. These sections received no additional formal library instruction. CD-ROM databases and end-user online searching as well as instruction in the use of traditional sources was integrated into the curriculum of the other two sections and made available throughout the semester.

CD-ROM databases and end-user online databases are two information technologies indicative of those young engineers may expect to encounter in work situations upon completion of undergraduate studies. The strategies and skills required for the successful use of these resources can be expected to build toward the independent self-education competencies encouraged by the Carnegie Commission for undergraduate education. Research data indicated that engineering students were the least likely among students enrolled in the science and technical disciplines to know about and to utilize the literature of their field.[20] Further data indicated that this behavior could be expected to continue throughout the careers of practicing engineers.[21] Moreover, the need to develop such skills at the undergraduate level was deemed particularly important since most of the students in this population are not expected to obtain further formal education.[22]

CD-ROM technology has gained widespread acceptance in academic libraries.[23] Studies of its use in libraries demonstrate its enthusiastic acceptance by students.[24,25] Locally those experiences have been verified by the heavy use made of InfoTrac and such CD-ROM databases as ERIC, ABI Inform, and Psychological Abstracts. No studies located addressed the impact or relationship of the use of CD-ROM on scholarship.

Online searching, available for a number of years in academic libraries, has been studied widely. Recently vendors have offered lower priced versions of their services directly to end-users and to libraries on an after peak-use hours schedule. Such services as BRS/After Dark, Knowledge Index, Wilsearch, and CAS Online are increasingly available in libraries, and use reports available in the literature indicate that like CD-ROM, these more affordable datafiles are gaining enthusiastic acceptance.[26,27] Research has not yet appeared which considers the impact of the use of these services on student scholarship. Investigations of such relationships were viewed by the researchers as important.

Technical writing students involved in the project were trained in the use of CD-ROM and online searching and had regular access to these services. They met with a librarian for individual guidance on their research topics during the course and for guidance and assistance in the use of automated resources.

The purpose of round one was to compare two methods of library instruction to determine if one, course-integrated library instruction utilizing CD-ROM and end-user online searching, was positively associated with improvement in student capabilities in retrieving, evaluating, and communicating in writing information on a technical topic. Evaluation of the

impact of automated databases, locally owned and through commercial networks, as an element in the improvement of student output is needed by academic libraries currently under pressure to add them as a service. If the desired improvements could be attained, the technical writing curriculum would be revised to reflect such instruction for all students.

The final objective was the evaluation of the methodology of assessment utilized in the project. The method was used with success once on a small scale. This project was planned to utilize it in repeated trials to determine if, in an area fraught with measurement complexity, similar results might be achieved consistently.

The project utilized personnel from the University Library System including librarian instructors whose primary assignment is the provision of information services to engineering and science students and faculty. The School of Library and Information Studies provided research expertise through the services of two faculty members and a doctoral student. The English Department cooperated through its Coordinator of Technical Writing and other faculty in the preparation, execution and evaluation of library instruction in the curriculum.

Resources utilized included fifteen student workstations each of which consists of a PS/2-60 IBM microcomputer with a CD-ROM player, modem, 5 1/4" and 3 1/2" external disk drives, 8513 color monitor. Two printers were available and downloading to disk was optional. An instructor workstation provided appropriate software testing and record maintenance. An LCD aided group instruction. Software included the following CD-ROM databases: NTIS, General Science Index, Applied Science and Technology Index, and Science Citation Index. Online databases were searched through DIALOG's Knowledge

Index. Students developed search skills and strategies and retrieved information for evaluation.

In addition, all students were able to utilize print information resources of the Science and Engineering Libraries as well as other library services and resources as needed.

Results

A total of 56 technical writing students completed all requirements of the study and provided research papers suitable for the data analysis phase of the first round of the project.

Students assigned themselves to the four available class sections based on schedule needs and preferences. Except for Section I, which was listed under the Technical Writing Coordinator's name, instructors were listed as "staff" in the class schedule so that without effort students generally could not choose class sections based on assumptions about the instructor. It was believed that through this process students could be expected to be randomly distributed over the four sections by ability, interest in technical writing, and other possible performance affecting attributes.

Twenty-nine students completed project requirements in two control course sections. They received the standard lecture orientation to library research. They were given Engineering Library floor plans and encouraged to utilize library staff assistance in their term paper research. Twenty-seven students completed all project requirements in two experimental course sections and received the same traditional lecture orientation as the control groups. In addition the experimental sections attended three special sessions on the availability and use of CD-ROM and online bibliographic databases. They were given the schedule of the electronic laboratory and encouraged to

make an appointment with the lab instructor to discuss term paper topics, previously selected under the guidance of section instructors, and to select and search databases appropriate for topics chosen. Once initiated, experimental sections students could utilize the laboratory whenever it was open.

At this point is should be noted that the electronic laboratory was originally set-up in temporary quarters pending the completion of the Science and Engineering Library. Not only was it not in the library as planned, but it was three floors away in a somewhat remote section of the classroom building which also housed the Engineering Library.

Staffing the electronic laboratory was made more difficult because of its location; nonetheless it was open for use an average of thirty hours per week during round one of the project. The hours were set after discussion with students in the experimental sections. Daytime, evening, and weekend hours were established to provide wide use options. Students were not forced to use the room except for the three initial group sessions to learn to use CD-ROM and online bibliographic databases. Individualized instruction was then available for those who sought it. All but four students took advantage of this instruction.

Data maintained on the use of the room revealed that students overall used the laboratory to develop a basic list of potential sources. Once in hand, most students were not likely to return to search for additional sources. Students expressed enthusiasm for the efficiency, effectiveness, speed, and ease of use of such searching. They recognized it as a useful tool to be accessed as needed. By and large they were well acquainted with the use

of computers in other areas and had utilized them in a variety of learning and work tasks and for recreation.

A few students were quite enthusiastic and returned to the classroom to search databases for technical writing and other assignments. During the following semester several students sought permission to continue to utilize laboratory resources for new assignments and were granted permission so long as it did not interfere with the needs of technical writing students.

Papers with appended bibliographic were received from 56 students (29 controls, 27 experimental). Identifying cover sheets were removed by the project director, leaving on abstract, the paper itself, and its bibliography. Each paper was given a number randomly assigned with all papers mixed together in one sequence. The papers were read and the bibliographies scored by two laboratory instructors, using the Kohl/Wilson system. The original electronic laboratory coordinator left the University before the end of the first round, and thus did not participate in the scoring or subsequent data analysis. The instructors who scored the bibliographies were both librarians, one of them a doctoral student in the School of Library and Information Studies.

The Kohl/Wilson scoring method was used to check each bibliography to determine:

1. if the source use was appropriate for the topic,
2. if the source selected appropriately represented the need for current versus retrospective materials,
3. the quality of the source for the topic.

Each of these criteria was scored on a four-point scale in which 0 = completely inappropriate, 1 = marginally appropriate, 2 = acceptable, and 3 =

superior. [28] The scores for these three items were added together and divided by three to give an overall score for each bibliography.

It was important to develop two scores for each bibliography to determine if independently acting instructors would evaluate the bibliographies comparably. If scores varied widely, further statistical analysis of the date would be useless. Fortunately, Pearson Correlation analysis demonstrated a strong relationship between the papers scored by the two instructors with a Pearson R of .776 and R2 of .602. and a significance level of .01.

The next and more important concern was whether the two instructional methods produced differences in the scores assigned the bibliographies. T-tests were used to determine whether there were statistically significant differences in bibliographies produced from technical writing instruction that included only the traditional library orientation as opposed to those produced from the same instruction supplemented with education in and use of automated bibliographical resources. This required the development of a single set of scores for the control group and for the experimental group. This was achieved by adding the scores for each bibliography assigned by the two instructors and dividing by two.

Table I shows the first set of scores comparing the control and experimental groups. Using the pooled variance estimate, no statistically significant difference was observed.

Table I.

Pooled Variance Estimate — Two Tailed Test

T-Value	Degrees of Freedom	Significance
1.40	54	.168

This result indicated that the addition of automated bibliographic sources had not made a difference in bibliographies appended to term papers submitted by students in the control and experimental class sections. It was learned, however, in the analysis stage that, in fact, some, perhaps many, of the students in the control sections had utilized a CD-ROM database in the Engineering Library. Other such databases, available in each campus library, may have been used. The actual degree of such use was unknown, but could have been a contributing factor in the outcome. This, as well, is not clear and presents the need for additional data development and analysis in future rounds. A questionnaire has been developed for use in round two, now underway, to gather data from control section students about types of sources used. It will be administered at the point when term papers are submitted.

Three technical writing instructors participated in round one. Two taught experimental sections, and the other taught the two control sections. Table II shows each of the experimental sections as compared to the control group. Teacher A shows a statistically significant difference against the control group at the .01 level. Teacher B shows no such difference. Further analysis revealed no statistically significant difference between the scores of the two experimental sections.

Table II

Pooled Variance Estimate			Two-Tailed Test Teacher
T-Value	Degrees of Freedom		Significance Level
A	3.14	38	.01
B	1.09	43	____

An examination of the scores of Teacher A and follow up discussion regarding classroom strategies suggested the possibility of a teacher effect on student achievement as revealed in the bibliography ratings. Teacher A reported factors summarized by Brophy as influencing positive achievement among students[29] more so than did the other experimental section instructor. Research over the last fifteen years indicates that some teachers elicit higher achievement from comparable students than do other teachers. Two common themes cut across the findings. One is that achievement is influenced by the amount of time students are engaged in appropriate academic tasks. The second is that students learn more effectively when teachers structure new information for them and relate it to what students know, and then monitor performance and provide corrective feedback during active recitation, drill, practice, and application activities.[30]

While no conclusion can be drawn from round one data regarding the possibility that teacher A's instructional strategy itself differed substantially from that of teacher B, plans have been made to examine this phenomena carefully in future rounds in which teacher A may participate. In the next such round teacher A will instruct a control section instead of an experimental section, and a trained observer will make random sample

observations of classroom activities conducted by each participating instructor. Though this broadens the scope of analysis devised for the project, it is a recognition that factors effecting achievement are multifaceted and difficult to assess.

No attempt was made to determine the relationship of term paper grades to bibliography ratings. Kohl and Wilson found no correlation among these scores.[31] They concluded that term paper grades reflect many factors, including student ability to use the library, but also such factors as writing talent, proofreading, and following instructions. These observations are in keeping with a wide range of studies on this topic which show at best low to moderate correlations among student grades and achievement.[32]

Finally, initial plans for round one included the availability of word processing for the preparation of term papers by students in the experimental sections. Because of problems related to the temporary organization and location of the electronic laboratory, as well as concerns about staffing and equipment security, the electronic laboratory coordinator recommended that word processing not be made available in round one. As well, students reported access to word processing capabilities in other settings. A decision has been made to include word processing in round three when the electronic laboratory will be housed permanently in the new Science and Engineering Library scheduled to open in the summer of 1990. It is hoped that the more convenient location and the availability of word processing, plus the addition of new CD-ROM database will result in greater use of the laboratory by students enrolled in experimental sections of the technical writing course.

Conclusions

The development of useful data regarding effective strategies for eliciting positive student achievement is made difficult by the extreme complexity of human interaction and the processes through which people learn. The use of repeated trials, five for this project, allows for corrections and improvement in data gathering and analysis over a three year period. This strategy may be particularly useful in the development of evaluation practices for librarians as they consider the effect of library user education on student scholarly output.

Typically librarians have relied on use perceptions of instruction and user comfort with staff and materials as measures of effectiveness. Such reports, often flattering, have not provided data relating library instruction to the improvement of works of scholarship. Moreover, objective measures have not been used to examine the usefulness of library materials, some of them, particularly current automated databases, very costly in terms of basic purchase, staff time, and maintenance.

Round one of this project does not clarify the picture. It indicated the need for additional data gathering and analysis and suggested useful additions to the study. It does indicate that students and technical writing instructors, enthusiastic about the efficiency, speed, and effectiveness of automated bibliographic searching, regard it as a useful resource to be utilized as needed. It does not positively relate the use of automated bibliographic resources to a measure of student scholarship.

Round one also evaluated the methodology developed by Kohl and Wilson to judge student scholarship through ratings of bibliographies appended to required term papers. No decision was made to revise this method in future

rounds though it was decided that additional data should be gathered on the implementation of the agreed upon instructional strategy through random observation of classroom instructors.

Generalizations should not be made from round one of the study. Rather it should be viewed as a steeping stone on a path from which useful data about library instruction strategies will be developed and refined over the course of the research project.

Dissemination Plan

Plans for dissemination of round one include publications to be presented to:

1. ERIC,
2. DIALOG OnDisc News,
3. a library journal,
4. a technical writing journal, and
5. an engineering journal.

As well, an oral presentation is scheduled for the Research Forum at the Alabama Library Association Annual Meeting in April, 1990.

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